Soyfoods for Infants, Children & Adolescents

Prepared by Mark Messina, PhD

Establishing healthful eating habits early in life is important for two reasons. First, childhood eating habits track into adulthood and changing adult dietary behavior is difficult.[1-5] Second, evidence suggests that health behaviors in childhood and adolescence can affect the risk of developing certain chronic diseases later in life.[6-8]

For example, obesity in childhood is associated with an increased mortality from cardiovascular disease in adulthood, independent of adult weight.[9] Early lifestyle factors are also known to affect the likelihood of developing breast cancer during adulthood.[10] These observations are important given that 20 percent of U.S. children are overweight[11] and diseases once seen primarily only in adults, such as hypertension[12] and non-insulin dependent diabetes mellitus,[13] are increasingly common in childhood. It is also recognized that the beginning stages of chronic diseases, such as coronary heart disease, are already apparent in adolescents.[14]

Given the importance of early-life dietary behavior, it is important to understand how the nutritional attributes of soyfoods may impact the health of young people from infancy through the teenage years.

Soy Infant Formula

Although breast milk is the ideal food for infants,[15] about one-third of women choose not to breast feed. Of those who do, most switch to formula feeding at some point in the infant's first year.[16] Commercially-prepared, fortified infant formulas are appropriate to supplement or replace human milk during the first year of life. Cow's milk formula is the most commonly used product, but about 20 percent of infants are fed soy formula for some period of time.[17]

An allergy to milk protein is among the most common reasons for placing an infant on soy formula. There is clear evidence that soy formula is hypoallergenic relative to cow's milk formulas.[18] However, because 10 to 14 percent of infants who are allergic to cow's milk formula are also allergic to soy formula, the American Academy of Pediatrics (AAP) suggests that many infants with documented cow's milk protein allergy should be switched directly to a hydrolyzed protein formula.[19] In contrast, an Australian panel of experts recently concluded that soy formula is an appropriate alternative for infants over six months old who demonstrated immediate food allergy to cow's milk and delayed reaction in the form of atopic eczema and other gastrointestinal syndromes.[20]

Isoflavones in Diets of Infants Fed Soy Formula

An estimated 20 million people in the United States have consumed soy formula during infancy since it became commercially available in the 1960s.[17] Although a few cases of goiter were identified in the mid-1960s, [21-23] this problem was eliminated with the advent of iodine fortification of the formula. Since then, no problems related to soy formula consumption have been identified over this long history of use.

Soy formula may be contraindicated for infants with congenital hypothyroidism who require synthetic thyroid hormone, however.[24] There is some evidence that soy is one of a number of dietary components that may interfere with the absorption of medication in these infants.[25] However, research shows that soy infant formula leads to normal short-term growth and development.[17, 26-29]

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Despite widespread use over several decades, soy formula has become somewhat controversial in recent years due to the naturally high isoflavone content of soy protein.[30, 31] Isoflavones, often referred to as phytoestrogens, exhibit estrogen-like effects under certain experimental conditions.[32] However, isoflavones are not the same as estrogen.

Soyfoods provide high-quality protein and most are low in saturated fat.

Research conducted among adults show that many biological measures affected by the hormone estrogen are not affected by isoflavones.[33-53] There is no clinical evidence in infants that soy formula consumption leads to adverse effects.[26, 54, 55]

Long-term data is limited, but no meaningful differences in a host of biological parameters between adults fed soy formula or cow's milk formula as infants have been seen.[56] Also, recent research has shown that young children fed soy formula as infants experienced no hormone-related abnormalities.[57] In fact, results from a small preliminary study found that girls fed soy formula as infants were between 40 and 60 percent less likely to develop breast cancer as adults, compared to women who were fed breast milk, cow's milk formula or a combination of both in infancy.[58]

Soy protein directly lowers cholesterol levels in children.

A comprehensive review published in 2004 summarized views on the isoflavone content of soy formula with this statement: "The evidence from laboratories showing biological activities at doses or tissue concentrations relevant to soy-fed infants is difficult to reconcile with the long record of uneventful use of these formulas."[59]

This statement is similar to the current position of the AAP, which was issued in 2008: "… although studied by numerous investigators in various species, there is no conclusive evidence from animal, adult human or infant populations that dietary soy isoflavones may adversely affect human development, reproduction or endocrine function."[19]

Because it is not feasible to conduct safety-related research in humans, animal studies are frequently cited in support of potential adverse effects. Results of these studies are of limited value, however, since there are many physiological differences between animals and humans. Also, many animals, including rodents and monkeys, metabolize isoflavones very differently than humans.[60] Therefore, any extrapolation of animal findings to humans should be done with considerable caution.

Effects of Soy Protein on Cholesterol Levels in Children

As in adults,[61] clinical research in children shows that soy protein directly lowers serum cholesterol levels and improves levels of other lipids.[62-66] In the most recent study, when soy protein (average intake 0.5 g/kg body weight) was incorporated into the diets of children and adolescents (mean age, 8.8 years; range 4-18 years) with familial and polygenic hypercholesterolemia, low density lipoprotein cholesterol decreased by 6.4 percent beyond the 11 percent decrease that occurred in response to the adoption of a standard low-saturated fat diet during the three-month run-in period.[66] Thus, soy protein, used in combination with other dietary therapies, may reduce cholesterol levels to target goals.[67]

Soy protein may also serve as an adjunct to therapy in children taking medication for lowering cholesterol, thereby reducing the required dose. This may help to minimize or eliminate side effects.

Soy Protein Quality

Soyfoods provide high-quality protein and most are low in saturated fat.[68] Soy protein can meet protein needs of growing children, and in 2000, the U.S. Department of Agriculture removed limits on the amount of soy protein that can be used in the National School Lunch Program.[69]

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Providing healthful sources of protein without excessive saturated fat content is important for children. Higher protein diets are associated with greater satiety and weight loss.[70] Also, recent evidence in young boys shows that consumption of protein above the recommended dietary allowance enhances the favorable impact of physical activity on bone mineral density.[71]

However, many protein-rich foods in children's diets are high in saturated fat. Therefore, substituting soyfoods for more traditional sources of protein generally improves overall diet quality. Even substituting soy protein for part of the beef or pork protein in a recipe can lead to a decrease in the fat, saturated fat and calorie content for the total entree, as long as portion size stays the same.[72, 73] Similarly, combining cheese, eggs or meat with tofu leads to improved nutritional quality of entrees.[74]

In general, soyfoods help children meet the Dietary Guidelines.[72, 74] Short-term studies show that soyfoods support the normal growth and development of children,[75] and improve growth when substituted for legumes in the diets of malnourished preschoolers.[76, 77] Thus, soyfoods can play an important part in a healthy and varied diet.

Acceptance of Soyfoods in Children's Diets

Soyfoods are generally well-accepted by children according to studies.[74, 78, 79] For example, among preschool children aged three to six years who attended a Head Start program, children consumed soy-enhanced lunches as readily as those made with more traditional ingredients, as evidenced by the amounts eaten.[78]

Negative beliefs about soy's palatability persist among some populations, however. When non-vegetarian subjects were told that a product contained soy, they were more likely to rate it as "grainy, chalky, dry and unappealing" even when the product did not actually contain any soy ingredients.[80] Foods containing soy are also generally thought by U.S. consumers to be more "healthy tasting."[80] Ratings reflect the amount of soy consumed by a given individual.

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Soy Protein and Allergies

Essentially all food proteins have the potential to cause allergic reactions in some individuals. Although soy protein is one of the eight food proteins responsible for approximately 90 percent of all allergic reactions, these eight foods are not equally allergenic. The number of adults allergic to soy is quite small.[81]

The relative number of children allergic to soy protein is almost certainly higher than the number of adults because children are much more sensitive to dietary proteins.[82] However, most children are thought to outgrow their soy allergies early on in life[82] although the pace at which this occurs is a matter of some recent discussion.[83] One recent study reported that more than 80 percent of infants outgrew their soy allergy by two years of age.[84]

Isoflavones in Children's Diets

Recent preliminary data suggest that children actually absorb isoflavones to a greater extent than adults.[85] Although soyfoods have been consumed by Asian children for centuries without any apparent adverse effects, there is much interest in understanding the biological effects of isoflavones in children.

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Data suggests that soy intake during adolescence reduces breast cancer risk later in life.

An Australian study published in 2008 looked at the effects of isoflavones on high-density lipoprotein (HDL) levels.[86] Results suggest that isoflavones do not exert estrogenic effects in teenage boys. HDL levels decrease in boys as they enter puberty whereas no such decrease occurs in girls, a difference that may be due to the higher estrogen levels in females. Isoflavones therefore might be expected to lower HDL in pubescent boys if they exerted estrogenic effects, but in the Australian study, no such changes occurred. Of course, this was only one possible measure of estrogenicity. In this regard, it is worth noting that recently presented meta-analyses, although involving adults, failed to find that either soy protein or isoflavones appreciably affect reproductive hormone levels in men or women.[87]

Finally, there are speculative, although very intriguing epidemiologic and animal data, suggesting that soy intake during adolescence reduces breast cancer risk later in life.[88-90] This evidence is consistent with mounting data that early life events greatly impact breast cancer risk.[91] The first twenty years of life appear to be particularly important.[92]

Research from the University of Alabama has shown that when rats are given the primary isoflavone in soybeans for just a few weeks early in life and then put on a typical laboratory diet, they develop 50 percent fewer tumors then rats not given this isoflavone.[88] These studies show that isoflavone exposure causes mammary cells to be changed in a way that makes them permanently less likely to be transformed into cancer cells later in life. The protective effects of early pregnancy appear to work through a similar mechanism.[91]

In agreement with the animal findings, women from Shanghai who consumed the equivalent of about 1.5 servings of soyfoods daily when they were 13 to 15 years of age, were 50 percent less likely to develop breast cancer as adults, compared to Chinese women who consumed little soy during adolescence.[89]

The potential public health benefit of modest soy consumption during childhood and adolescence cannot be overstated.

More recently, researchers from the National Cancer Institute reported that, in comparison to low-soy consumers, women who were classified as high-soy consumers at ages 5-11, 12-19 and 20+ years, were 58, 21 and 29 percent less likely to develop breast cancer, respectively.[93] Also, a just-published U.S. study found that higher soyfood intake during adolescence was associated with a 28 percent reduction in adult breast cancer risk, whereas consuming higher amounts of soy during adulthood was only very modestly protective.[90] Clearly, the potential public health benefit of modest soy consumption during childhood and adolescence cannot be overstated.

Summary and Conclusions

Establishing good eating habits early in life is important. Childhood dietary intake may impact adult chronic disease risk and influence eating habits in adulthood. Soyfoods provide important options for improving the diets of young people and research shows that these foods are acceptable to children.

Therefore, soyfoods can be viewed as healthy additions to the diets of children and adolescents. Other than relatively rare soy protein allergy, there is no clinical evidence that soyfoods exert any adverse effects. To the contrary, there is evidence suggesting that exposure to soy during childhood and/or adolescence reduces breast cancer risk later in life.

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